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THE JOURNAL
OF
THE ROYAL ASTRONOMICAL SOCIETY OF CANADA

DEVOTED TO THE ADVANCEMENT OF ASTRONOMY AND ALLIED SCIENCES

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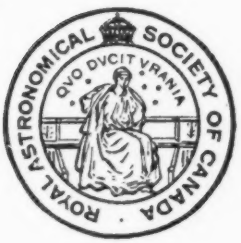

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THE JOURNAL
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ROYAL ASTRONOMICAL SOCIETY
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CURRENT PROGRESS IN ASTRONOMY

By W. E. HARPER

(President's Annual Address, read at Toronto, February 12, 1929)

GENERAL

Before entering upon my subject proper may I be permitted to say a personal word or two. I feel the honour the Royal Astronomical Society of Canada has done me in electing me for the second time as their President, and I would like to be worthy in some small sense of the trust thus reposed in me. While on the surface it is a very delightful arrangement for myself to be accorded the honour of being President whilst others perform many of the duties attached to the office, yet no one at heart desires to be a recipient of favours without making return in some form or other for the same. As I am separated by a few thousand miles from the Head Office of the Society it is out of the question to attend the Toronto meetings unless other matters should bring me East. If such an opportunity presents itself during the present year I shall be only too happy to serve the Toronto Society, and the other Eastern ones as well, in any way deemed best to themselves.

For the past year it seemed to me that any efforts that might be directed to strengthening the local Society would help the Society as a whole. Such help is hardly necessary where we have such energetic officers as we have in Victoria, but by means of articles in the local papers and magazines and by numerous addresses of a popular nature, possibly some help has been given. A wider circle has been reached by the radio talks given by your

President over CFCT for the past year. Two per month were given last winter, one per month during the summer and present winter, all at a definite hour. From the responses that casually came to hand, it might appear advisable to have similar brief talks in other sections of Canada as well, particularly in the prairie provinces.

But more than anything else your President felt that if any possible help could be given Dr. Chant in securing material of a suitable character for our JOURNAL such would be the most direct way of aiding the Society as a whole. The Editor's job is a particularly trying one, even when he has plenty of material from which he can pick and choose, but it is rendered all the harder if there is an actual dearth of suitable material. While I would not wish to infer that the review of our Seminar meetings at this Observatory and some of my radio talks are most suitable, they have at least been placed at the disposal of the Editor, and I fancy from these and other sources the supply of material is more satisfactory than formerly was the case.

International Union. Any review that aims to cover only a single year's work in astronomy would be rather fragmentary as astronomical researches usually extend over several years. We can keep in mind though for this summary such investigations as have either been completed the past year or from which there has crystallized out some definite and important result. Mention should properly be made of the meeting this year at Leiden of the International Astronomical Union and of some of the conclusions there arrived at, but as the Editor of our JOURNAL was a Canadian delegate and has given us in the November issue a résumé of the proceedings, further reference on my part is unnecessary.

The general plan I shall follow is to treat the material under four headings: (1) Solar System, (2) Stellar Universe, (3) Related Advances in Physics and (4) New Equipment.

(1) THE SOLAR SYSTEM

Solar Activity. The maximum of the present cycle of solar activity seems to have been reached during the year 1927. It is true the early months of 1928 showed an increase which, however, did not attain the high level of 1927. Confirmatory evidence is

seen in the fact that the average latitude of the spots during 1927 was 15°, about where the maximum occurs, while during the past year a decrease in the average latitude was shown, in keeping with the observed tendency for the spots to die out at latitudes of about 10°.

Observations of the solar radiation in ultra-violet light show a marked parallelism with the curve of sun spot numbers. It is evident, therefore, from these observations of Pettit that the principal changes in the light of the sun as a variable star are in the ultra-violet.

Planet Photography: Venus. During the past year considerable work has been done on the photography of the planets. Hitherto photographs of Mars have been made with ordinary plates and with those sensitive to red light only, the latter being assumed to depict the surface features of the planet and yielding smaller images than those in blue light. Mention may be made of recent work of Ross on Venus and of Wright on Jupiter. Ross, at Mount Wilson, photographed Venus in ultra-violet, blue and infra-red light and finds the diameter in ultra-violet light about two per cent. greater than that in red light. The outer atmosphere of Venus is considered to be composed of a thin stratum of cirrus clouds, billowy in character, while the inner atmosphere is exceedingly dense and yellowish in colour. Many investigations have previously been undertaken to determine the planet's rotation period, and one school of observers hold to a period about 24 hours whilst another school believe it to correspond to the period of revolution, namely, 225 days. Dark areas appear on these photographs of Ross, taken with the 60- and 100-inch telescopes, which show a banded structure. The changes in these details are so rapid that it is felt the period of rotation is not nearly so long as 225 days. Spectroscopic evidence is not conclusive, but from a wealth of such evidence at the Lowell and Mount Wilson observatories it would appear that the period must be longer, however, than a day, and so a compromise value of about 30 days is suggested.

Jupiter. Wright's photographs of Jupiter were made with the Crossley reflector and were taken in six different colours from ultra-violet to infra-red. In the infra-red the darkening of the limb

is well marked, while its complete absence from the ultra-violet photographs suggest that the latter represent the planet's outermost layers. The ultra-violet images are thus the larger and are clear cut whereas the infra-red images, representing lower levels of the planet are smaller and lacking in sharpness at the edges. For the first time moving pictures have been made recording the actual rotation of the planet. Its period of rotation is about 10 hours, and by photographing at intervals through three consecutive nights and piecing the films together, an appearance of continuity in its axial rotation was secured by Wright, assisted by Mees of the Eastman Research Laboratory. These films were exhibited the past year at a meeting of the Royal Astronomical Society in London.

Brief mention may be made also of ultra-violet photographs of the moon by Pettit, which show a few areas relatively much darker than on the usual photographs.

Comets. Unlike the previous year 1927, in which many comets were discovered, the past year has recorded but few. Six of the previous year were followed a portion of the year and Stearns, 1927 d, was followed throughout the year. Two new ones were discovered in 1928, the first by Reinmuth on February 22 and the second by Giacobini on March 17. Both were very faint. A third was discovered by Forbes at Cape Town on November 19, but was shown to be the same as one which appeared in 1873 whose period, therefore, is 55 years. Five comets are due to return this year, two in March and one in each of the months August, September and November.

Asteroids. During the last six months of 1926 asteroids to the number of 65 were discovered whilst 101 were added in 1927. Information is not to hand as to the exact number that are new among the later ones, but probably 1,100 would be a fair approximation to the number known at the beginning of 1928. Leuschner at Berkeley is undertaking to check over the published observations and orbits of each minor planet that has been discovered, in short, to write a life history of each.

(2) The Stellar Universe

Radial Velocities. During the past year the Lick Observatory issued Volume XVI of their Publications containing the results of

the radial velocities secured by them in the great programme of work covering almost thirty years. While some of the results have appeared previously in other journals, yet many of them are given for the first time and, moreover, certain systematic corrections are applied to the results to bring them all into a homogeneous system. In this catalogue are included the results from their southern station at Santiago, Chile, which last year was sold to a Catholic College of that city. During the twenty-five years of its existence this southern station secured 10,301 spectra, while about 15,000 spectrograms were secured at Mount Hamilton. Omitting stars whose velocities exceed 60 km. per sec. there remained results for 2,149 stars, and from these the speed for the solar motion was determined as 19.65 km. per sec. directed to an apex at $\alpha = 270°.6$ and $\delta = +29°.2$.

The Cape Town 24-inch telescope formerly devoted to radial velocity determinations is now being used in parallax work. Their radial velocity results, hitherto unpublished in their *Annals*, for 434 stars appear in Volume X just to hand. *A Second Catalogue of Radial Velocities*, as compiled by Voûte, was issued during the year. As the author failed to include the Lick results, just off the press about the same time, and moreover failed to secure many other recent lists of velocities, the catalogue was practically out of date when issued. Discussion is now taking place in the Radial Velocity Committee of the International Astronomical Union as to the best means and time of issuing a new one.

Double Stars. A double star catalogue to replace the monumental one of Burnham's in 1906 is in course of preparation by Aitken of the Lick Observatory and will be issued in the near future. Marked activity is shown in double star observations, particularly in the southern hemisphere, where two new telescopes have entered the field, one at Johannesburg and the other at Bloemfontein. At the latter 410 new double stars were discovered during the first five months of its operation, from May to October, 1928. At the Union Observatory at Johannesburg, according to Van den Bos, they have discovered a visual binary star with the shortest known period, namely, one of 3½ years.

Form and Dimensions of Universe. Our ideas concerning the total number of the stars has undergone many changes in recent

years, but the number seems to be always on the increase. As it is impossible to deal with the whole sky, representative regions are selected, the number within each magnitude interval counted, and this number multiplied by a factor to sum up for the whole sky. The Mount Wilson and Groningen observatories have jointly carried on such an investigation and the results were given by Seares in the early part of last year. The work required the establishment of a scale of photographic sequences in each selected area based upon the standard north polar sequence. For this it was necessary to measure the intensities of about 65,000 star images down to a limiting magnitude of 18.5, a piece of work in itself of no small magnitude.

Seares' conclusions may be summed up very briefly. The number of stars reachable with the 100-inch reflector is about 1,000 million. If the invisible stars behave as we would expect them to behave from the relations found to exist among the stars of steadily increasing faintness, then the total number ought to be about 30 times as great, or thirty billion. The "local cluster" idea is upheld by these counts and Seares deduces that its diameter is of the order of 20,000 light years and that it includes many million stars among which are stars as faint as the fifteenth or sixteenth magnitude. The remainder of the total number of stars are those found in remoter parts of our galactic system considered to be similar to a spiral nebula, 250,000 light years or more in diameter.

Rotation of Galaxy. This idea of our stellar universe being similar to a spiral nebula has in recent years come much to the fore again. With the increased number of radial velocities and parallaxes available in the past few years statistical discussions of the space velocities have been made, particularly by Strömberg, which show marked asymmetry of motion for certain groups of stars. Such asymmetry is a striking feature of stars of high velocity whose space velocities show a marked preference for a definite direction. Such asymmetries of motion would be explainable if, following Lindblad, we conceive our galactic system to be similar to other spiral nebulae and to consist of sub-systems rotating about a common axis. These sub-systems would be symmetrical about the common axis, would be approximately in a state of

dynamical equilibrium and each would have a definite rate of rotation.

Papers by Oort in the *Bulletin of the Astronomical Institute of the Netherlands*, and one by Dr. Plaskett in *Monthly Notices*, and in our own JOURNAL the past year adduce observational evidence tending to verify the soundness of such an assumption. Oort's results indicate that our solar system is distant from the galactic centre about 20,000 light-years only about one-third the distance assigned by Shapley eleven years ago from his discussion of the mean distances of globular clusters. The mass required at the centre to give the requisite rotational velocity to account for the peculiar asymmetries would be of the order of 8×10^{10} times that of our sun, and the question arises as to why we have not visible evidence of the existence of such a great mass.

Galactic Centre and Mass. This central nucleus is situated in the plane of the galaxy and in galactic longitude approximately 325°, in the general direction of the constellation *Sagittarius*. Here the Milky Way clouds are brighter than in other parts of the sky, and Pannekoek examines their total luminosity to see if they would yield the necessary mass. He is forced to admit that on the most favourable assumptions as to their distances and the area that might reasonably be included, the visible stars of the galactic system cannot provide the central attracting mass required. The question arises, would not the dark matter in our system yield this attracting mass. Photographs of distant spirals seen edge-on suggest enormous masses of obscuring material. Similar evidence is afforded nearer home in the almost complete obliteration of faint stars in certain regions of the sky by occulting matter which must be extremely tenuous but nevertheless of great effect when summed up over large volumes of space. Eddington assumes that in interstellar space there is one atom per cubic inch and computation shows that in a sphere whose diameter is less than 20,000 light years the total mass of such obscuring material would be 10^{11} times the sun's mass. If this were in any sense collected locally about the galactic nucleus it would furnish the requisite attractive force.

In this connection brief mention may be made of a paper by Struve published the past year in which evidence is adduced to

support the idea of calcium clouds in interstellar space. There are many objections to such a theory which has been long held but from the strength of the ionized calcium line at 3,933 in about 1,700 spectra there seemed to be an increasing strength of the line shown for objects at increa ing distances.

Harvard Programme on Galactic Centre. The whole question of the real existence of a massive nucleus at the galactic centre is vital to an accurate conception of the form of our universe. At Harvard, Shapley has undertaken a rather ambitious programme on the galactic dimensions and structure and intends to use all kinds of variable stars to the end of securing distances. The aim is to secure complete information of all variables found in 240 selected star fields, most of which are in the belt of the Milky Way. In one region near to the galactic centre a star cloud was found exceptionally rich in variable stars, and from the data secured this cloud is at a distance of 47,000 light years. This is the first result from a programme which is expected to last for ten years at least.

Number of Nebulae. The dimensions of the greater system, in which one thinks of our stellar universe as one of millions, has been added to by the work of Hubble. A previous summary referred to his deduction that the Andromeda spiral is at a distance of a milion light years. It is tacitly assumed that others of smaller angular diameter are at relatively greater distances. The numbers of these fainter nebula can seemingly be increased indefinitely by increasing the exposure. Hubble finds a correlation between exposure time and numbers of nebulae, the numbers increasing at approximately the theoretical rate for uniform distribution in depth. In high galactic latitudes, with an exposure of two hours using the 100-inch, about 170 nebulae per square degree are found. One of these faint distant nebulae was recently found to have the amazing velocity of 4,000 km. per sec. recession from our solar system.

Cosmic Rays. About 25 years ago, when the writer was a student in these halls of learning (University of Toronto), Professor McLennan was conducting experiments upon the discharge of electroscopes, finding that they were discharged by radiations of some unknown character. Of the many workers who have entered the field since those initial experiments the most outstanding is

Millikan, whose researches on these cosmic rays, as this radiation has come to be called, tend to conclusions of a revolutionary character. A very complete summary is given by himself in the September 28th issue of *Science*, which should be read by anyone interested. The evidence obtained by Millikan and his associates is that this penetrating radiation is of extremely short wave length, having oscillations a hundred times more rapid than those accompanying radio-active processes, that it comes to us from interstellar space and is associated with the creation or building up of the more common elements like helium, oxygen, silicon and iron out of primordial hydrogen nuclei and electrons. This is a very revolutionary idea and if the conclusions are substantiated the universe need never be considered in future as one running down all the time, but one in which the energy so prodigally radiated from our sun and distant stars again finds itself transformed into matter.

(3) Related Advances in Physics

Revision of Rowland's Table. I shall dwell now upon some developments in the realms of physics which have a direct bearing upon astronomy. The table of solar wave lengths determined from grating spectra many years ago by Rowland has long been known to contain small errors, and for several years at Mount Wilson St. John and his associates have been engaged in revising the table. There has been a careful elimination of the errors of the older system, and the solar wave lengths are given to three decimals in International Angstrom Units. The table contains a great number of new and revised identifications made possible by our recent knowledge of the series relations of spectral lines. Of the 20,000 lines in the Rowland region 57 per cent. have been referred to their sources. The unidentified remainder are very faint. The presence of six elements not known previously in the sun's atmosphere has been established in the course of this work.

The extension of the table toward longer wave lengths has been made possible by Babcock's investigation of the infra-red solar spectrum beyond the region previously photographed. The principal lines are shown as far as $\lambda 11900$ and some 1,800 lines up to $\lambda 10218$ have been measured and are included in the table.

The relative intensities that multiplet lines in stellar spectra should have can be calculated from theory. These theoretical intensities may be assumed to be proportional to the numbers of active atoms producing the lines. Russell, Adams and Miss Moore at Mount Wilson, have thus established a relationship between the relative numbers of atoms producing a solar line and the corresponding Rowland intensity for that line. Such a relationship may be applied to stellar spectra if the Rowland scale of intensities is employed.

Relation of Line Intensities to Physical Conditions. By using high dispersion spectrograms of bright stars Russell and Adams have thus determined the amounts of metallic vapour present above stellar photospheres, their temperatures and other physical conditions. It is found that the assumption of a condition of thermodynamic equilibrium is not a valid one, but after correcting for this by an empirical method, temperatures are derived in good agreement with those found by other methods. The amounts of metallic vapour above equal areas of the photosphere of the cooler *c*-stars like α Orionis seem to be of the order of 100 times as great as in the case of the sun; and the strength of the enhanced lines in such stars suggest that they are produced largely in extensive chromospheres supported by radiation pressure.

Nebulium. Towards the end of 1927 the mystery surrounding the origin of the unknown lines in the bright-line spectra of the diffuse and planetary nebulae was cleared up. The unknown hypothetical element to which such lines were supposed to be due had been designated *nebulium.* From the character of the other elements hydrogen, helium, carbon, nitrogen and oxygen known to be present in the nebulae it was quite certain that these lines must be emitted by some element of low atomic weight. The development of present ideas concerning atomic structure showed that there was no place in the table of elements for such an element and hence these lines must be due to one or more familiar elements existing under unfamiliar conditions. Russell suggested low density as the unfamiliar condition as in the nebulae extremely low densities are the rule. Under such conditions an electron can jump from one orbit to another which, under ordinary conditions, would not be possible or at least probable. The possibilities of such "forbidden

transitions" were examined by Bowen at Pasadena, and with the actual intensities of the nebular lines as a guide he was able to show that nebulium was none other than the chief constituents of the air we breathe, namely, oxygen and nitrogen, the atoms of which, in the extremely rarefied nebular gas, are in a singly and doubly ionized condition. The lines cannot be obtained in the laboratory because we cannot duplicate nebular conditions.

Ether Drift. In 1925 Dayton C. Miller, working at Mount Wilson, obtained results which seemed to show that there was a drift of the ether relative to the earth of 10 km. per sec. As these results involved a considerable readjustment of theories of the ether they again stirred up much discussion on this question which dated from the Michelson-Morley experiment of 1887. During the past year Michelson, Pearson and Pease, working at Mount Wilson with the 11-foot rotating interferometer, find no displacement of the fringes observed by Miller. Certain minor disturbances amounting to some hundredths of a fringe were found which were ascribed, however, to a combination of temperature effects and strains in the interferometer frame. When the interferometer was placed on a cast-iron plate floating in a mercury bath and enclosed in a double room these minor disturbances disappeared and thus their results are directly opposed to those of Miller. It is difficult to know how to reconcile the opposing results as both groups are highly trained workers and have the reputation of exercising care in their experimental work. It seems likely, however, that the effect is null and that Miller's positive results were due to some unknown source of error.

(4) New Equipment

Ordinary Observatories. The last phase of our outline is the new instrumental equipment which the year has seen brought into use or projected. Almost every part of the world shows signs of activity in this regard. Even China is renewing her youth in that she is securing modern equipment for the old established Peking Observatory. Japan has ordered a 26-inch refractor for the Tokio Observatory, and there is also a possibility of a large reflector for a national observatory in the near future. Russia's 40-inch reflector, installed at the Simeis Observatory, two years ago, is producing results in the radial velocity line, while last year

saw the largest refractor in the world 41 inches in diameter, established within her borders. Sweden and Edinburgh both have large reflecting telescopes under way, whilst much activity is shown in South Africa. Here, after many delays, the Ann Arbor Observatory's southern station, known as the Lamont-Hussey Observatory, commenced active work in May last. Close co-operation exists with the Union Observatory at Johannesburg, where similar work started a year or so earlier. The Yale photographic telescope, also at Johannesburg, is rapidly increasing the number of known parallaxes in the Southern Hemisphere. The Harvard College Observatory have removed from Arequipa, Peru, and established a station near the Ann Arbor one at Bloemfontein. They expect to have a new 60-inch reflector in operation soon, and so the southern skies will soon be as well observed as are the northern to-day.

University Observatories. Observatories have come to be almost an essential part of any university aiming to give post-graduate work in science and many new telescopes have recently been completed or are under way for American universities. To mention only a few we have a 12½-inch at Columbia, a 30-inch at Illinois, a 24-inch in the making for Kansas, a large reflector for Texas, where a bequest for $1,200,000 was left for that purpose, and lastly the Ohio Wesleyan University, for which a fine 70-inch disk was cast last January by the Bureau of Standards.

200-Inch Telescope. In a class by itself stands the proposed 200-inch telescope to be erected near Pasadena and financed by the International Educational Board. It is hoped to cast the huge disk, weighing between 25 and 30 tons, out of quartz so as to avoid deformation of the mirror due to changes of temperature. It will be several years before it can be an accomplished fact, but when completed it should carry us out to greater depths of space than have yet been sounded and enable us to resolve some of those distant island universes which are seen now in our largest telescope only as the merest glimmers of light.

The writer recognizes that the foregoing summary is rather fragmentary in character as much of the work of English and Continental astronomers has been passed over. However, to keep the article within the limits suggested, much must be left unsaid, but it is hoped that attention has been drawn at least to some of the high spots in the many advances of the past year.

ANNUAL GENERAL MEETING OF THE ROYAL ASTRONOMICAL SOCIETY OF CANADA

The meeting was held at 8 p.m. on January 15, 1929, in the Physics Building of the University of Toronto, R. K. Young, Ph.D., first Vice-President, in the Chair.

The minutes of the last annual meeting, having been printed, were taken as read and confirmed.

The General Secretary, Dr. L. Gilchrist, presented the reports of the various centres—Montreal, Ottawa, Toronto, London, Winnipeg and Victoria, B C.—which were approved.

Reports were presented from the General Treasurer, the Librarian, the Curator and the Assistant Secretary on the general membership, all of which were read and adopted.

The ballots cast for officers for the ensuing year were submitted, when Dr. L. Gilchrist, General Secretary, and Miss E. M. Budd, Assistant, were requested to act as scrutineers to count the ballots.

A vote of thanks to the auditors, Mr. A. R. Hassard and Dr. J. B. Fraser, was adopted, and they were requested to act for the coming year.

On motion by A. F. Hunter, seconded by Dr. L. Gilchrist, it was resolved that the General Council be asked to consider the allocation of the Building Fund.

The result of the election of officers for 1929 was announced by the scrutineers, and confirmed, as follows:

Honorary President—J. S. Plaskett, F.R.S., Victoria, B.C.
President—W. E. Harper, M.A., Victoria, B.C.
First Vice-President—R. K. Young, Ph.D., Toronto.
Second Vice-President—Mgr. C. P. Choquette, M.A., Montreal.
General Secretary—L. Gilchrist, Ph.D., Toronto.
General Treasurer—H. W. Barker, Toronto.
Recorder—E. J. A. Kennedy, Toronto.
Librarian—C. A. Chant, Ph.D., Toronto.
Curator—Robert S. Duncan, Toronto.
Council—Miss A. Vibert Douglas, Ph.D., Montreal; R. A. Gray, B.A., Toronto; E. A. Hodgson, M.A., Ottawa; J. H. Horning, M.A., Toronto; R. E. DeLury, Ph.D., Ottawa; Col. W. E. Lyman, Montreal; Rev. Dr. D. B. Marsh, Jarvis; John Satterly, D.Sc., Toronto; L. A. H. Warren, Ph.D., Winnipeg; E. T. White, D.Paed., London, Ont.

Membership of the Society

The Membership of the Society on December 31st, 1928, as shown by the Reports of the different Centres, was as follows:

	1928	1927
Toronto	253	260
Ottawa	57	65
Victoria	100	84
Montreal	95	117
Winnipeg	37	48
London	40	40
	582	614
Life Members	14	14
Honorary Fellows	11	12
Foreign Members and Subscribers to Journal	50	31
	657	671

Eva M. Budd,
Assistant Secretary.

Librarian's Report

During 1928 the Library was continued in the same manner as in previous recent years. The accommodation is scanty and not very satisfactory, but nothing better is in sight at present.

The Assistant Librarian has prepared the following statistics:

Number of periodicals received during 1928:	
From Canada and the Empire	172
From the United States	194
From other countries	216
	582
The Journal sent in exchange to addresses in	
Canada and the Empire	46
The United States	50
Other countries	52
	148

Among the books added to the Library (other than periodicals) were:

An Outline of Stellar Astronomy by Peter Doig, 1927.

Stars and Atoms by A. S. Eddington, 1927.

Life in the Stars by Sir Francis Younghusband, 1927.
Report on Change of Calendar, League of Nations, 1926.
The Constellations and their History by C. White, 1928.
Norton's Star Atlas, 4th edition, 1927.
Isostasy by W. Bowie, 1927.
Sir Isaac Newton, a bi-centenary evaluation of his work edited by F. E. Brasch, 1927.
Life and Work of Sir Norman Lockyer, 1928.

C. A. CHANT,
Librarian.

CURATOR'S REPORT

There have been few requests for lantern slides during the past year, but we have been endeavouring to make use of them at the meetings as much as possible, both to make the same more interesting and also to let the members know that we have such slides for use.

The Larratt Smith telescope is out and in use.

ROBT. S. DUNCAN,
Curator.

ANNUAL REPORTS OF THE SECRETARIES FOR THE CENTRES

TORONTO

The following meetings were held in Toronto during the year 1928:

Jan. 24—Mr. F. T. Stanford led discussion on Conditions on Mars.
Feb. 14—Mr. J. R. Gibbs—Thunder and Lightning.
Feb. 28—Rev. Dr. D. B. Marsh—Comets.
Mar. 13—Prof. L. B. Stewart—A Trip to the Yukon in the Early Days.
Mar. 27—Prof. A. T. DeLury—Civilization's Debt to Mathematics.
Apr. 10—Dr. C. A. Taylor—Conservation of Sight.
Apr. 24—Dr. J. B. Fraser—The Relation of Astronomy to Medicine.
May 8—Wm. Gore, C.E.—Astronomy in the Life of an Engineer.
May 22—Open Air meeting on University Campus with telescopes.
Oct. 9—R. K. Young, Ph.D.—Some Problems in Astronomy.
Oct. 23—A. F. Hunter, M.A., and A. R. Hassard, B.C.L.—Notes and Summer Observations.
Nov. 6—Prof. C. A. Chant—Meeting of the International Astronomical Union.
Nov. 20—R. E. DeLury, M.A., Ph.D.—What we know about the Sun.
Dec. 4—Prof. E. F. Burton—The Scattering of Light.
Dec. 18—Mr. E. J. A. Kennedy and Mr. S. C. Brown—The Winter Constellations

The meetings of the Society at Toronto are held in the Physics Building of the University of Toronto and the public are invited. On the whole the interest in the meetings has improved during the past year, and it was found necessary to hold several of them in the large auditorium.

E. J. A. KENNEDY
Secretary.

OTTAWA

During the past season public lectures were given in the auditorium of the National Museum by the President, Dr. Ami, on the "Eclipse of the Sun in June, 1927" as seen by himself in England, and by Dr. DeLury on "Sun Spots of 1927", in November; by Mr. A. J. Ames on "Making of Optical Lenses in England during War Time", in January; by Dr. R. J. McDiarmid on "Man's Relation to Astronomy", in March; on April 16th by Douglas Barlow, M.A., on "Planetary Life with particular reference to Mars", and on April 30th by Mr. W. H. Herbert on "The Romance of the Compass".

An effort to secure some eminent astronomer to address the Society in co-operation with other Ontario centres was not successful.

Messrs. H. B. Laing of Ottawa and Donald Chisholm of Fort William resigned from the Society.

Mr. W. H. Christie has been transferred from the Victoria Centre to the Ottawa Centre, and Mr. J. G. McMurtie of Toronto to c/o C.N.R.O., Ottawa.

A number of names on our list are two and three years in arrears with their fees. It is suggested they should be dropped unless these arrears are promptly paid up.

A. H. HAWKINS,
Secretary.

MONTREAL

During the 1927-28 season six public lectures were given at meetings of the Society, as follows:

Stars and Atoms—Dr. A. Vibert Douglas.
Motion and the Heavenly Bodies—Dr. A. S. Eve, F.R.S.

Research Problems of the Harvard Observatory—Dr. A. J. Cannon.
The Total Eclipse of the Sun, 1927—Mgr. C. P. Choquette.
The Properties of Light—Dr. D. A. Keys.
Phenomena of Mind, Geometry and the Planets—Mr. G. Sample.

The membership in May, 1928, stood at 121; 11 new members were elected during the year, and 7 resigned, were transferred to other centres or died.

By order of the Council, which met on May 3, 1928, a letter was sent to every member whose fees were unpaid for one or more years stating that failure to pay the fees owing would be regarded as equivalent to resignation. This has reduced our list of members to 95.

A. VIBERT DOUGLAS,
Secretary.

LONDON

During the year 1928 the London Centre of the R.A.S.C. held eight regular meetings. These meetings were well attended, and the discussions which followed the addresses showed very clearly that the members take a keen interest in the study of astronomy. The principal addresses given were as follows:

Jan. 13—Worlds in the Making—Mr. E. H. McKone, B.A., B.Paed.
Feb. 10—The Solar System—Rev. W. G. Colgrove, M.A., B.D.
Mar. 9—The Study of the Heavens and the Exercise of the Imagination—Mr. E. T. White, B.A., D.Paed.
Apr. 13—Practical Exercise in Constructing an Automatic Star Guide—H. R. Kingston, M.A., Ph.D.
June 9—Observation Meeting followed by an address on "A Survey of the Field of Astronomy" by Dean Buchanan of the University of British Columbia.
Nov. 9—Jupiter—Miss N. Norris.
Finding the Relative Position of the Planets on a Heliocentric Chart—Mr. T. C. Benson.

The active membership for the year was forty with all fees paid.

It is with deep regret that we report the death of Miss Grace Blackburn, a charter member of the Society.

E. T. WHITE,
Secretary.

Winnipeg

The Winnipeg Centre of the Royal Astronomical Society has completed a successful year and the members have taken a great interest in the progress of the Society.

There were seven regular meetings during the year, all of which were open to the public and which were well attended.

Executive meetings were held on three occasions (3rd February, 11th April and 18th October).

Six new members were elected and one resignation was received. With regret we record the death of Mr. I. F. Brooks, who was a member for many years and took a keen interest in the affairs of the Society.

A special meeting was arranged on the 28th of May, when the Winnipeg Centre had the pleasure of hearing Mr. R. Meldrum Stewart, Director of the Dominion Observatory at Ottawa.

Mr. Stewart gave an illustrated address on "The Dominion Observatory and its Work".

The dates of the regular meetings, the lecturers and the subjects of the lectures were as follows:

Jan. 11—Light and Vision—Professor Frank Allen.
Feb. 3—Relativity—Professor Frank Allen.
Mar. 14—Some Remarks on Jupiter and Saturn—Mr. C. E. Bastin.
Motion—Mr. A. W. Megget.
Lenses—Mr. D. Saunders.
Apr. 11—Star Clocks and Sun Dials—Prof. V. W. Jackson.
Oct. 24—The Royal Observatory at Greenwich—Dr. N. J. MacLean.
Nov. 14—Shall We Radio to Mars—Mr. D. R. P. Coats.
The Call of the Stars—Mr. A. W. Megget.
Dec. 5—Moving pictures of Comets and other Heavenly Bodies.
The films used on this occasion were kindly lent by the Educational Extension Department of the Ontario Government.

At the annual meeting, which was held on the 5th day of December 1928, the following officers were elected for 1929:

President—L. A. H. Warren, M.A., Ph.D., F.R.A.S.
Vice-President—N. J. MacLean, M.D., F.A.C.S.
Treasurer—Mr. J. H. Kolb.
Secretary—Mrs. J. Norris.

Council—Mr. C. E. Bastin, Mr. D. R. P. Coats, Mrs. J. C. Howey, Mr. A. W. Megget, Right Rev. T. W. Morton, Mrs. E. L. Taylor.
Auditors—Messrs. C. E. Bastin and James Houston.

S. C. NORRIS,
Secretary.

VICTORIA

The number of members on the nominal roll of the Victoria Centre at the beginning of the year was 81. There have been 2 resignations, 14 new members have been elected and 7 members have been transferred to Victoria from other centres. This brings the total present enrolment up to 100—a gratifying increase.

In addition to 8 regular meetings of the Society 3 council meetings have been held. The yearly programme of public meetings has been very successful, the lectures being of a high order and well attended.

The record of the public meetings held, with names of lecturers and subjects, is as follows:

Jan. 24, Dr. D. Buchanan—Astronomical Discoveries.
Feb. 21, Dr. J. S. Plaskett—The Motions of the Stars.
Mar. 23, Dr. M. Y. Williams—The History of the Earth from Pre-Cambrian to the Present Time.
Apr. 17, Dr. H. Zanstra—The Nebulae, the Luminous Clouds of Space.
May 31, Open air meeting—Observations conducted by J. A. Pearce, Mr. R. M. Petrie and Mr. C. S. Beals.
Oct. 23, Mr. F. Napier Denison—Address on the work of Gonzales Observatory. The members of the Society were the guests of Mr. Denison at Gonzales.
Nov. 13, Dr. J. S. Plaskett—The Meetings of the International Astronomical Union at Leiden.
Dec. 4, Mr. J. A. Pearce—Our Wonderful Universe.

The practice has been adopted of devoting a short period of time at the close of each meeting to observation of heavenly bodies. It is hoped to continue this practice in the future.

C. S. BEALS,
Secretary.

GENERAL TREASURER'S FINANCIAL STATEMENT FOR YEAR ENDING DECEMBER 31, 1928

GENERAL ACCOUNT

Receipts, 1928

Cash in Bank, December 31, 1927	$ 830.41	
Grant from Dominion Government	2,000.00	
Grant from City of Toronto (Toronto)	100.00	
University of Toronto (50 Journals)	100.00	
Fees of General Members	773.35	
Fees of Members (Toronto)	328.95	
Bank Interest	65.56	
		$4,198.27

Disbursements, 1928

Publication Journal and Handbook	$1,923.20		
Less received for Reprints	56.50	$1,866.70	
Public Meetings (Toronto)		81.14	
Library Books and Binding		135.81	
Salary—Assistant Librarian		540.00	
Stationery and Stamps, Ceneral		169.77	
Stationery and Stamps (Toronto)		10.00	
Advertising and Postage re Meetings (Toronto)		97.94	
Rent of Library and Office		120.00	
Grants—Ottawa Centre	$56.00		
Winnipeg Centre	37.00		
Montreal Centre	30.00		
Victoria Centre	49.00		
London, Ont., Centre	39.00		
		211.00	
Miscellaneous Expenses		33.85	
Balance in Imperial Bank		932.06	
			$4,198.27

BUILDING ACCOUNT

Receipts

Balance, December 31, 1927—$322.82	$322.82	
Interest—Bond $173.75; Bk. 10.03	183.78	
Balance in Bank (a/c 293)	506.60	

LIFE MEMBERSHIP ACCOUNT

Receipts

Balance, December 31, 1927	$30.58

Interest, Bond, $5, Bk. .93	5.93
Balance in Bank (a/c 322)	36.51

H. W. BARKER,
General Treasurer.

Audited and found correct
January 11, 1928
JNO. B. FRASER }
A. R. HASSARD } *Auditors.*

TREASURERS' REPORTS FOR THE CENTRES

OTTAWA

RECEIPTS

Balance from 1927	$21.62	
Grant from General Treasurer	56.00	
Interest	1.12	
Total Receipts		$78.74

EXPENDITURES

Postage and Stationery	$ 8.10	
Incidentals	3.00	
Lantern Operator	2.00	
Total Expenditures	13.10	
Balance on Hand	65.64	
Grand Total		$78.74

The collection of fees for the calendar year 1927 amounted to $112.00 and so far this year $80.00 have been collected.

J. F. FREDETTE,
Treasurer

Audited and found correct,
R. C. PURSER.
Dec. 14, 1928.

MONTREAL

Year beginning November 1st, 1927 and ending November 1st, 1928.

RECEIPTS

Balance carried forward from last year	$ 71.14
6 Arrears Collected for 1926	12.00

6 Arrears Collected for 1927	12.00	
87 Fees Collected for 1928	174.00	
Grant from Miss Jane Fleet	23.00	
Grant from General Treasurer	30.00	
Bank Interest	2.40	
		$324.54

DISBURSEMENTS

Remitted Fees to General Treasurer		$198.00	
Lecture Expenses—Dr. A. J. Cannon	$35.25		
Dr. Eve, Expenses	3.50		
Telegrams, Taxi	5.50		
		44.25	
Expenses, Mr. G. Sample, Taxi		2.00	
Postage and Stationery		12.00	
Janitor Service at Meetings		9.00	
Lantern Operator		14.00	
Printing		10.88	
Advertising		7.56	
Cash on Hand and in Bank		26.85	
			$324.54

LONDON

TREASURER'S FINANCIAL STATEMENT FROM DECEMBER 9, 1927, TO DECEMBER 14, 1928

RECEIPTS

Balance brought forward, Cash	$ 57.47
Fees for 1927	2.00
Fees for 1928	80.00
Fees for 1929 paid in advance	22.00
Grant from General Treasurer	39.00
Interest on deposits	1.85
	$202.32

DISBURSEMENTS

Forwarded, fees to General Treasurer		$ 82.00
Printing Notices for Meetings		16.80
Postage, Stationery, Exchange		3.92
Mr. Fetchell, Honorarium		2.00
Expenses *re* Observation Meeting		7.53
On Hand { Fees paid in advance for 1929		22.00
On Hand { Cash		68.07
		$202.32

E. T. WHITE,
Secretary-Treasurer.

Audited and found correct
Dec. 14th, 1928.

(Signed) {FREDERICK H. COATES, E. H. McKONE} *Auditors.*

WINNIPEG

TREASURER'S REPORT FOR YEAR ENDING DECEMBER 5, 1928

RECEIPTS

Cash in Bank December, 1927		$157.87
Bank Interest	$ 5.39	
Grant from General Treasurer	37.00	
26 Members' Subscriptions, 1928	52.00	
5 Members' Subscriptions, 1929	10.00	
		104.39
		$262.26

DISBURSEMENTS

Printing, Advertising, etc	$30.65	
Operation of Lantern	12.00	
Exchange on Cheque	.15	
Telegram	.83	
Postage	5.06	
		48.69
Balance in Bank		213.57
		$262.26

Audited and found correct
Dec. 5th, 1928

(Signed) {L. A. WARREN, C. E. BASTIN} *Auditors.*

NOTE.—37 members 1928 subscriptions ($74.00) remitted to Toronto after the Annual Meeting.

J. H. KOLB,
Treasurer.

Victoria

Treasurer's Report, 1928

Receipts

Balance from last year	$ 43.60
Membership fees	146.00
Bank interest	1.00
Grant from General Treasurer	49.00
	$239.60

Expenditures

Expenses of lecturers	$ 14.77
Janitor's services	12.50
Advertising	30.80
Office supplies	1.15
Stamps	5.30
Stationery	12.31
Remittance to Toronto	138.00
Cash on Hand	24.77
	$239.60

C. S. Beals
Treasurer.

Audited and found correct
W. T. Bridge, *Auditor.*
Dec. 1st, 1928.

NEWS AND COMMENTS

A new Hope-Jones "Synchronome" clock has been ordered for the Dominion Observatory to supplement the other Ottawa master-clocks. This clock, of which great things are expected, will be placed in the new underground clock-vault to which the two Rieflers have been transferred.

To observe the total solar eclipse on May 9, Dr. John Jackson, Chief Assistant of the Royal Observatory, Greenwich, and Dr. J. A. Carroll, Assistant Director of the Solar Physics Observatory at Cambridge, have proceeded to Alor Star, in Kedah, in the Malay Peninsula, where they will be joined later by Dr. Aston of Cambridge. Professor F. J. M. Stratton, Cambridge, accompanied by Mr. P. J. Melotte, Greenwich, will occupy a station at Pattani, on the east coast of southern Siam, where they hope to have the help of Dr. T. Royds, Director of the Kodaikanal Observatory, and Colonel J. W. Cohen, who took part with Professor Stratton in observing the eclipse in Sumatra in 1926.

Dr. Heber D. Curtis, Director of the Allegheny Observatory, Dr. John A. Miller, Swarthmore College, and party, were due to reach Sumatra on February 27. They expect to occupy a site in the mountains near the northern tip of Sumatra to observe the eclipse of the sun on May 9.

We learn from *Science* that an exchange has been arranged between Princeton University and the Lowell Observatory at Flagstaff, Arizona, according to which Dr. Carl Lampland will work at Princeton while Raymond S. Dugan will work at Flagstaff.

In the January issue reference was made to the retirement of Prof. H. F. Newall from the professorship of astrophysics at Cambridge University, which position he had filled gratuitously for nearly forty years. He has been succeeded by Lieut.-Col. F. J. M. Stratton.

Mr. P. M. Millman, a student in his final year in the Arts Faculty at the University of Toronto, has been appointed Assistant in the Department of Astronomy, Harvard University. He will begin his duties in September next. Mr. Millman has spent the summers of 1927 and 1928 at the Observatory at Victoria.

REDEL.

NOTES AND QUERIES

Communications are invited, especially from amateurs. The Editor will try to secure answers to queries.

The Crescent Venus seen with the Naked Eye

Continuing the discussion of this subject begun in the January issue, Mr. Merritt A. Brown, of Toronto, writes:

> Some time ago we had just said good-bye to some friends. I was going into the house when my wife called: "Merritt, is there a star that looks like a crescent?" I said: "Yes, Venus looks like a crescent sometimes, but I never saw it so except when looking into a telescope." She showed me the star. I said-"That is Venus." Then I got the opera glass and still could not see it as a crescent though she said it was quite clear to her as a crescent.
>
> At the next meeting of the Society I asked Dr. Chant about it and he replied that he did not think it was possible to see it as a crescent except with a telescope.

I should be very pleased to receive further evidence on this matter. It might also prove an interesting subject for laboratory experiments. When at its greatest brilliancy (as it will be on March 15 and May 26 next) Venus has an angular diameter of about 40″, which is the angular width of a circle one inch in diameter at a distance of 430 feet. The thickness of the crescent at this time is 26 per cent. of the diameter of the disc. By cutting out of a sheet of black paper a crescent one-fourth of an inch at its widest place, the convex edge being a portion of a circle one inch in diameter, and then holding it in front of a bright source of light 430 feet away the geometrical conditions are similar to those in the case of the planet in the sky. The sheet of paper may be illuminated in various ways to represent the sky background.

Endowment of Professor Russell's Chair

A handsome compliment has recently been paid to Henry Norris Russell by the fellow-members of his class of '87 at Princeton, who have presented to their *Alma Mater* the sum of $200,000 to endow the chair of astronomy held by Dr. Russell. A portrait of Dr. Russell accompanied the gift. It may be recalled that this chair in astronomy was formerly occupied by the distinguished astronomer, Charles A. Young.

A Creditable Achievement

In the adjoining cut is shown a 12-inch reflector, the mirror and mounting of which was made by Mr. H. L. Rogers, a real estate broker, of Toronto. C. A. C.

A TWELVE-INCH REFLECTOR
Constructed by H. L. Rogers of Toronto.

MEETINGS OF THE SOCIETY

AT LONDON

At the Annual Meeting the following officers were elected for the year 1929:

President—H. R. Kingston, M.A., Ph.D., F.R.A.S.

Vice-President—Mrs. W. F. Boughner.

Secretary-Treasurer—E. T. White, B.A., D.Paed.

Council—Miss N. Morris, D. S. Ainslie, M.A., Ph.D.; Rev. R. J. Bowen, F.R.G.S.; Mr. T. C. Benson; Dr. W. S. Wismer.

AT VICTORIA

Annual Meeting.—The ballots for the election of officers were mailed to all members of the Centre in good standing, and the results of the election were as follows:

Honorary President—Prof. Daniel Buchanan, University of British Columbia, Vancouver, B.C.

President—J. A. Pearce, Dominion Astrophysical Observatory, Victoria.

1st Vice-President—Dr. C. S. Beals, Dominion Astrophysical Observatory Victoria.

2nd Vice-President—Dr. G. M. Shrum, University of British Columbia, Vancouver, B.C.

Secretary-Treasurer—Prof. W. Gage, Victoria College, Victoria.

The Council is as follows—Mr. G. A. Bucklin, Victoria; Mr. W. T. Bridge, Victoria; Rev. J. Goodfellow, Princeton; Mr. J. P. Hibben, Victoria; and Mr. P. H. Hughes, Victoria. Past Presidents—Dr. J. S. Plaskett, Mr. F. Napier Denison, Mr. W. S. Drewry, Mr. J. E. Umbach, Mr. W. E. Harper, Mr. J. Duff and Prof. P. H. Elliott.

January 15, 1929—The regular meeting was held in the Victoria College on Tuesday, January 15, at 8 p.m., President J. A. Pearce in the chair. The following were elected to membership:

F. L. Smith, Fisheries Experimental Station, Prince Rupert, B.C.

Mrs. M. Chambers, Alert Bay, B.C.

Mr. R. O. Redman, M.A., gave a brief address about the planets Mercury and Jupiter and explained the term "elongation."

The main address was given by Mr. W. E. Harper of the Dominion Astrophysical Observatory. Mr. Harper treated the subject "New Observatories" in a very capable manner, illustrating his lecture with many interesting lantern slides. The construction of larger and better telescopes, said the speaker, was occupying the attention of almost the whole world—China, Japan, Russia, Sweden, Spain, England, the United States, Canada, and South America, the only dark spot in the picture being Australia.

The speaker referred to the work of the American Universities in South America, South Africa and the United States. Mr. Harper discussed the construction of the 200-inch telescope at Mt. Wilson, explained the difficulties which had to be overcome, and by means of diagrams outlined the main points in its design.

In conclusion, the speaker pointed out that such a telescope would no doubt change many of our present theories and conceptions of the sidereal universe.

When the meeting adjourned members availed themselves of the opportunity of viewing celestial objects through the portable telescope.

February 12—The Society met in the Victoria College at 8 p.m., President J. A. Pearce in the chair. The following new members were elected:

Mrs. Lilias Middleton, Okanagan Landing, B.C.

Mr. Charles Ellis, Victoria, B.C.

Dr. C. S. Beals of the Dominion Astrophysical Observatory delivered a lecture on "Spectroscopy." In addition to many interesting slides the speaker had on hand several pieces of apparatus with which to illustrate his address. In beginning, the lecturer pointed out that the spectroscope is one of the most powerful tools of science, and he showed how the physicist and astronomer make use of it in finding the chemical constitution of the stars. Dr. Beals discussed the nature of light and the methods of obtaining spectra. Both continuous and line spectra were shown on the screen. The modern theory of the atom was then explained, and lantern slides illustrated the conceptions of the atoms of the various elements. The audience was greatly interested in the experiments arranged to show the process of ionization.

A hearty vote of thanks concluded the meeting.

WALTER H. GAGE,
Secretary.

AT WINNIPEG

November 14, 1928—The regular monthly meeting was held in Theatre "A" University Science Building at 8.15 p.m. The President, Mrs. E. L. Taylor, was in the chair.

The lecturers of the evening were Mr. D. R. P. Coats and Mr. A. W. Megget.

Mr. Coats, the subject of whose lecture was "Shall we radio to Mars," stated that many scientists of the present day were endeavouring to communicate with the planet Mars, but he did not think much good would be accomplished even if communication was established. One of the first difficulties presenting itself would be that of language. The Martians could scarcely be expected to understand the languages peculiar to the peoples dwelling here. Then, in order to build instruments with which to carry on communication with our planet, one must assume that the Martians are either human or superhuman, of a high type of intelligence, indeed that they have brain power equal to that possessed by the very best of our people. At present, however, it appears impossible for a radio wave length to pass through what is termed the "Heaviside layer" in

the atmosphere. When it reaches this layer it is reflected back to earth. Consequently, for the time being at least, communication is not possible.

Mr. A. W. Megget, who spoke on "The Call of the Stars," recommended the study of astronomy as a relaxation from one's daily toil. The lecturer sketched the history of astronomy from the time of Pythagoras, and told of the wonderful development in astronomical instruments, by means of which the bounds of vision have been widened. He next gave a short talk on the solar system, which was illustrated by several fine slides. One slide prepared from ten sketches made by Mr. Megget on ten consecutive nights in September, 1927, showing the rapid movement of the moons of Jupiter, was of special interest to the Society and was much appreciated. He also spoke of the wonders and beauty of the great star clusters in the constellation Hercules and Perseus and the Nebulae in Orion and Andromeda.

December 5—The regular monthly meeting was held in Theatre "A" University Science Building at 8.15 p.m. The President, Mrs. E. L. Taylor, was in the chair.

The following were elected to membership in the Society:

Rev. and Mrs. J. A. Bowman, 511 Greenwood Place, Winnipeg.

Mr. G. W. Davis, 130 Inkster Ave., Winnipeg.

Mrs. J. H. Kolb, 571 Anderson Ave., Winnipeg.

Rev. F. X. MacAuley, 353 St. Mary's Ave., Winnipeg.

Instead of the usual lecture, moving pictures were shown during the evening. The films, which were kindly lent by the Education Extension Department of the Ontario Government, were of a very instructive nature and were much appreciated by a large and enthusiastic audience. Pictures of the starry firmament—that limitless ocean which sparkles with countless points of light -of the earth, the planets and their satellites, the comets, and the most prominent member of the group, the sun, around which all other bodies revolve, were thrown on the screen. The magnitudes and the relative distances of the planets from the sun were well illustrated. Short explanations, which were given by Dr. Warren, enabled those present to understand more clearly the structure of the universe and the laws which govern the movements of the heavenly bodies.

S. C. Norris,
Secretary.

AT OTTAWA

The first meeting of the year was held on Friday, February 1st, 1929, at 8.15 p.m. in the National Museum. Mr. C. C. Smith, the President, was in the chair.

The lecturer for the evening was Mr. R. G. Madill, B.A., Assistant Magnetician, Dominion Observatory. The title of his lecture was "In Quest of Scientific Data."

Mr. Madill, who has spent five seasons in northern Canada securing magnetic data for the Dominion Observatory, spoke of the predicaments and difficulties incidental to such work, and illustrated his lecture with many interesting slides.

A summary of his lecture follows: "The Dominion Observatory, under the direction of R. Meldrum Stewart, M.A., has been since 1907 conducting a scientific magnetic survey of Canada. The Division of Terrestrial Magnetism, with C. A. French, B.A., in charge and R. G. Madill, B.A., as assistant, is responsible for this survey which is of great importance to the people of Canada in particular and to the whole scientific world in general.

The study of terrestrial magnetism necessitates the collection of magnetic data from all parts of the country, and for this purpose survey parties are operating in the field each summer. The securing of data in that part of the country served by the railways is not a difficult task, with the exception of little used railway such as the Hudson Bay railway in 1922. The lecturer, who spent five weeks in that year conducting a magnetic survey along this particular railway, had great difficulty in travelling over that portion of the track between Mile 214 and Mile 332, the end of steel, owing to numerous sun-kinks in the steel and washouts in the grade.

The greater part of Canada lies to the north of the railway belt. Gathering data from this part of the country means arduous labour in travelling by canoe. Very little difficulty is met with on the large rivers such as the Yukon and the Mackenzie. But the remainder of the rivers in northern Canada are rough and treacherous. The lecturer spent the two summer seasons of 1922 and 1923 on the rivers and lakes of northern Manitoba, and in that time travelled a distance of 3,800 miles. He described the strenuous labour in canoe travel in running rapids, tracking up rapids, tracking up rivers, walking up rivers, poling, and portaging. In the two seasons the lecturer assisted in 156 portages of the entire outfit and made as many more of instrumental equipment only. The portages varied in distance from a few feet to five miles.

The difficulties of canoe travel along the west coast of Hudson Bay around Port Churchill and Port Nelson were discussed, the rocky coast near Churchill being contrasted with the mud flats around Nelson. In telling of conducting magnetic surveys along the coast of Labrador and through Hudson Strait, the speaker pointed out the trials of the observer due to fog, gales, ice, the short days in the autumn and early winter. Other drawbacks to the collection of data from northern Canada were mentioned, the greatest of which is the shortage of food, especially in the barren lands.

The President tendered the thanks of the audience to the lecturer for his most interesting address.

M. S. BURLAND,
Secretary.

AT TORONTO

January 29, 1929—A regular meeting of the Society was held in the Physics Building of the University at 8 p.m. Mr. J. R. Collins in the chair.

The following were elected members:

James Thomas Moore, Architect, 4354 White Plains Ave., New York.

Rev. Paul A. McNally, Director Georgetown College Observatory, Washington, D.C.

Professor A. E. Johns, Brandon College, Brandon, Manitoba.

The lecturer of the evening was then introduced, Mr. J. R. Gibbs, F.R.M.S. His subject was, "Amundsen's Dash to the Pole, and the Astronomical Data necessary for such Expeditions."

After describing Amundsen's early life, his sailing the North West passage and locating the Magnetic North Pole were mentioned. Amundsen determined to attack the South Pole, Peary having just returned from the discovery of the North Pole. His judgment in taking dogs and skis and making his base on the great barrier were commented on. The severe cold of an Antarctic winter was stressed owing to the earth then being three million miles further away from the sun. Equipment was described, the building of the hut shown, also the laying of depôts at 80° 81′ and 82° S. The instruments used on the journey to the South Pole were 2 sextants, 2 artificial horizons, and four spirit compasses, the latter freezing at 40° F., and a hypsometer for giving height above sea level. Five men, four sledges and 52 dogs set out on October 20 and arrived at the South Pole on December 14th by dead reckoning, from the last observation taken. Then observations were taken every hour for 12 hours, giving their position as 89° 56′ S., about 5 miles from the Pole. Moving this distance due south, they once more took a series of observations over a period of 24 hours. These were submitted to Prof. Alexander, who found an upper culmination alt. of 23° 19.2′ and a lower culmination alt. of 23° 17.4′, giving a position of Lat. 89° 58.5′ S. and Long. 60 E.

Amundsen had to determine the variations of his compass by a series of bearings of the sun. One has to remember that the magnetic South Pole is situated in Lat. 72° 25′, Long. 155° 16′ E., over 1,200 miles from the South Pole.

After taking possession of the South Pole in the name of King Haakon of Norway, Amundsen returned to his base, having been away 99 days and travelled 1,740 miles.

Mr. A. F. Hunter expressed the thanks of the meeting, commenting on the interesting lecture, and mentioning particularly the valued slides shown, some of which had belonged to Sir Ernest Shackleton, the explorer, with whom the lecturer had been well acquainted.

E. J. A. Kennedy,
Secretary.

The Royal Astronomical Society of Canada

OFFICERS FOR 1929

Honorary President—J. S. PLASKETT, B.A., D.Sc., F.R.S., Victoria, B.C.
President—W. E. HARPER, M.A., Victoria, B.C.
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